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Aquatic Resources	- Provide for Ups	stream Passage of Anad	romous Fish										
EWG-1	Low Flow Channel	Impaired Fish Holding and Spawning HabitatPassage	Adult Chinook Salmon Holding Habitat and Spatial Separation of Spawning Spring-Run Chinook Salmon and Fall-RFun Chinook Salmon	Open Fish Barrier Pool to fish passage and allow the pool to be used as a spring Chinook salmon holding habitat . Requires the addition of a fish ladder to the Fish Barrier Dam and modifying the existing ladder with a branch to the Fish Barrier Pool. (FR-1)		X	X	X	X		X	SP-F3.1 SP-F10 Task 1E	Information is needed on feasibility of utilizing existing holding habitat for spring-run Chinook salmon in Fish Barrier Pool (March-June). This information is expected from SP-F10 Task 1E. If habitat exists, need conceptual design and costs. EWG-2A and EWG-2B provide different mechanisms for achieving a similar resource goal.
EWG-2 <u>A</u>	Low Flow Channel	Impaired Upstream Fish Passage and Holding and Spawning Habitat	Adult Chinook Salmon Upstream Passage and Spatial Separation of Spring-Run Chinook Salmon and Fall-Run Chinook Salmon	Install a weir at lower end of low flow section (from July 1 st to November 15 th) to selectively pass desired fish species into the low flow channel. Currently, fishes in the Feather River are allowed free access into the upper portions of the low flow channel. This Resource Action would address concerns about high salmonid spawning densities in the low flow channel and provide an opportunity to segregate the spring and fall runs of Chinook salmon in the Feather River. (FR-2)			X	X	X	X	X	The following plans may help the site selection: location and quality of spawning habitat: SF F10 Task 2A, 2B, 2C Location and quality of holding habitat: SF OF10 Task 1E-	It will provide information regarding locations where Spring-run Chinook salmon currently hold, which is information that would be required to identify a suitable location for the weir. This Resource Action would require a method for collecting adult fall-run Chinook salmon for the Feather River Fish Hatchery broodstock collection. This
EWG-2B	Low Flow Channel	Holding and Spawning Habitat	Adult Chinook salmon holding habitat and spatial separation of Spring-Run Chinook Salmon and Fall-Run Chinook Salmon	Install a size exclusion device such as a latticed grating near Bedrock Park from July 1 st to November 15 th in order to provide spatial separation of holding and spawning habitat for spring-run Chinook salmon and fall-run Chinook salmon. The latticed grate would be designed to block movement of adult salmonids but not juveniles.			<u>x</u>	X		X	<u>x</u>	The following plans may help the site selection: location and quality of spawning habitat: SF F10 Task 2A, 2B, 2C Location and quality of holding habitat: SF F10 Task 1E	conceptual design. SP-F10 Task TE will provide information regarding locations where Spring-run Chinook salmon currently hold, which is required to identify a suitable location for the size-exclusion device. This Resource Action would require a method for collecting adult fall-run Chinook salmon for the Feather River Fish Hatchery broodstock collection, which could potentially include a nature-like fishway which may also double as regging hebitat for salmonide. This Resource Action

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EWG 3	Low Flow Channel	Impaired Fish Passage	Adult Sturgeon Upstream Passage	This Resource Action would increase flows during critical upstream passage periods for sturgeon at Steep Riffle. Currently, flows in the low flow reach are maintained at 600 cfs, except during flood events or occasional temporary changes in project operations.		X	-	-X	X	X	x	SP F3.2 Task 3A; UCD study on sturgeon swimming performance	Potential cross resource impact on riparian vegetation and fluvial processes, depending on the magnitude of flow alterations. Timing of sturgeon upstream migration is February June. March June (spring run Chinook salmon), September December (fall run Chinook salmon), September January (steelhead), SP F10 Task 1C determined that under current operating parameters flow related physical passage impediments to adult salmonid upmigration are not apparent and May June (shad).
EWG4-A	High Flow Channel	Upstream Fish Passage	Adult upstream migration for shad and sturgeon at Shanghai Bench and Sunset Pumps	Provide pulse flows from the Thermalito Afterbay Outlet or the Thermalito Diversion Dam to the high flow section of the Feather River to facilitate upstream migration of adult sturgeon (February - June) and shad (May-June) to potentially reduce holding time below Shanghai Bench and Sunset Pumps. Under this Resource Action, the same acrefootage of water would be released over the upstream migration time period, but the regime would be altered so that the flow pattern would include pulses that would not have previously existed.		<u>X</u>		X		<u>X</u>	X	SP-F3.2 Task 3A; SP-F3.2 Task 5; UCD study on sturgeon swimming performance	Additional information needed regarding the magnitude of flow pulse desired (i.e., 2X base flow) and the frequency and duration with which the pulse desired (i.e., one week per month, one day per week). Providing pulse flows at these time could also benefit rearing salmonids and spawning and rearing splittail by providing inundated floodplain habitat (see EWG-XX). Providing pulse flows may also benefit spring-run Chinook salmon, steelhead, splittail, American shad, and sturgeon by doubling as attraction flows (see EWG-4B). Facilitating passage over Shanghai Bench using flow would require coordination with Yuba River operations. Pulse flows during this time period may result in redd dewatering or juvenile fish stranding for Chinook salmon and steelhead. Potential cross-resource effect on riparian vegetation and fluvial processes, depending on the magnitude of flow alterations. (Includes concepts previously embedded in EWG-9).
EWG-4 <u>B</u>	High Flow Channel	Impaired Fish Passage Attraction Flows	Provide-Attraction Flows for Adult Upstream Migration primarily for splittail, American shad and sturgeon and secondarily for spring- run Chinook salmon, and steelhead	Use Provide high flow pulses in winter-spring (Feb-May) as cues to that will serve as enhance attraction flows primarily for upstream migration of spring run Chinook salmon, shad (May - June), steelhead, sturgeon (February - June), and splittail (Jan - April). Secondarily, pulse flows would serve as attraction flows for spring-run Chinook salmon and steelhead. (FR-15) (FR-29)		X		- <u>X</u>	X	X	X	-SP-F3.2 Task 3A SP-F10 Task 1C SP-F10 Task 1A	Flow could originate forom the Thermalito Afterbay Outlet or the Thermalito Diversion Dam. Additional information needed regarding the magnitude of flow pulse desired (i.e., 2X base flow) and the frequency and duration with which the pulse desired (i.e., one week per month, one day per week). Providing pulse flows at these time could also benefit rearing salmonids and spawning and rearing splittail by providing inundated floodplain habitat (see EWG-XX). Providing pulse flows may also benefit upstream passage of adult American shad and sturgeon (see EWG-4A). Releases for attraction flows would require coordination with Yuba River operations. Need additional information on attraction and pulse flows. Potential cross-resource effect on riparian vegetation and fluvial processes, depending on the magnitude of flow alterations. Redds constructed in shallow water during pulse flows may result in dewatering or juvenile fish stranding (Chinook salmon and steelhead).

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EWG-5	High Flow Channel	Impaired Upstream Fish Passage	Adult Upstream Passage for Sturgeon and Shad	Under low flow conditions, Shanghai Bench and Sunset Pumps may be impassable for sturgeon and/or American shad due to high water velocities in some areas and/or a vertical height barrier. Structurally modify the Sunset Pumps and/or Shanghai Bench areas to aid passage of sturgeon, and shad. This Resource Action would provide physical changes to these areas to aid anadromous fish passage. (FR-16, FR-17) Options for physical changes include: Blast a section of Shanghai Bench to turn it into a chute Add a ladder at Shanghai Bench Add a ladder at Sunset Pumps Change channel configuration to increase the depth and proportion of flow in the existing side channel Change the channel configuration to create a low velocity side channel at Sunset Pumps		¥	X	- <u>X</u>	X	X	X	Upstream passage: Chinook: F10 Task 10 Sturgeon: F3.2 - Task 3A Shad: SP-F3.2 Task 5 UCD swimming performance study	Need velocity information under different low flow conditions.	
EWG 9	High Flow Channel	Impaired Fish Passage	Provide Increase Flows for Fish Passage Past Barriers	Provide increase flows to allow fish passage over barriers in lower Feather River. (FR-21)		X	-	-	X	X	¥	SP F3.2 Task 3A SP F10 Task 1C SP F10 Task 1A	These additional flows would help to provide passage beyond Sunset Pumps and Shanghai Bench. [Flows in the Yuba River also effect passage at Sunset Pumps.] Passage would be most beneficial for sturgeon, shad and Chinook (under low flow/dry year conditions). This Resource Action differs form EWG 4 in that EWG 9 provides flows to allow for passage, while EWG 4 provides attraction flows encourage migration. Also related to EWG 5. (Incorporated into EWG-4A)	
EWG-97	Lake Oroville	Impaired Upstream Fish Passage	Adult Anadromous Spring-run Chinook Fish-Upstream Passage	Provide upstream passage of anadromous fish (e.g., spring-run Chinook) through trap and transport program. [Passage would be to locations upstream of Oroville Dam including the upstream tributaries.]		¥	X	X	X	X	X	SP-F15	This Resource Action is a placeholder for the potential re-introduction of spring-run Chinook to the upstream tributaries of Lake Oroville. Information-An upstream fish passage PM&E description is forthcoming from NOAA Fisheries. SP-F15 will provide an analysis of the feasibility of providing passage for anadromous fish upstream of Lake Oroville using a wide variety of fish passage mechanisms/programs. There is also a concern related to potential fish disease, predation, genetic introgression and potential competition for food and habitat with resident fish.	

Aquatic Resources - Provide for Passage of Resident Fish

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EWG-10A	Upstream Tributaries	Impaired <u>Upstream</u> Fish Passage	Upstream Passage of Lake Oroville's Resident Fish	Provide resident fish with access to the upstream tributaries by removing sediment plugs which occur where block access to the upstream tributaries on the control of the c		¥	X	X	x	X	x	-Characterization of existing upstream migration barriers: SP-F3.1 Task 1A -Fish species composition in upstream tributaries: SP-F3.1 Task 1B -Fish species composition in Lake Oroville: SP-F3.1 Task 2A -Interactions between reservoir fish and tributary fish: SP-F5/7 Task 3	introgression, and competition for food and habitat.
EWG-10B	Upstream Tributaries	Impaired <u>Upstream</u> Fish Passage	Upstream Passage of Lake Oroville's Resident Fish	Provide resident fish with access to the upstream tributaries by removing boulders, and manmade barriers to increase the quantity and quality of available salmonid spawning habitat. This Resource Action could include the removal of Big Bend Dam or the construction/repair of fish passage facilities at this site to open up the Poe Reach. (LO-5, LO-6, LO-7)		¥	X	X	x	X	x	-Fish species composition in upstream tributaries: SP-F3.1 Task 1B -Fish species composition in Lake Oroville: SP-F3.1 Task 2A	Combines similar Resource Actions by removing upstream barriers. Similar to EWG-10A. Related to EWG-96. Evaluation of introducing fish in Lake Oroville to areas that they have not had access to should include consideration of: predation, disease transmission, genetic introgression, and competition for food and habitat. This resource actimary result in impacts to the recreational fishery in Lake Oroville if fish which were previously unable to pass into the upstream tributaries are now capable of migrating into the tributaries. Management goals in existing fisheries in upstream tributaries may conflict with the idea of introduction of Lake Oroville fish species into upstream tributaries. For example, the Poe reach is trying to manage for a trout fishery and it may be contradictory to their management goals to introduce bass species from Lake Oroville into the upstream tributaries.
atic Resources -	Limit Downstro	eam Passage of Hatchery	Produced Trout to Mir	nimize Potential Effects on Natural Steelhead Reproduction									
EWG-11	High Flow Channel	Interaction of Stocked Fish Passage Enhancementwith ESA-listed Fish Species	Passage of Stocked Rainbow Trout from the Thermalito Complex Into Feather River	Prevent downstream passage of rainbow trout from the Thermalito Complex into the Feather River. Currently rainbow trout are stocked in the Thermalito Forebay for a "put and take" fishery. This Resource Action will address concerns about hatchery-origin trout interacting with natural steelhead in the Feather River. (TC-1) Opportunities to prevent downstream passage of rainbow trout include changing the species that are stocked in Forebay (i.e., stock steelhead, Chinook salmon, coho salmon or brown trout instead of rainbow trout) or eliminating stocking in Forebay. Install a device (e.g., fish screens) at the Thermalito Afterbay Outlet, the Thermalito Power Plant, or the tailrace that will prevent downstream passage of rainbow trout from the Thermalito Forebay into the Feather River. (TC-1)			X	X	X	X	x	reservoir fish and	Obtain information from screw trap and snorkel surveys to assess impacts level. Need to define specific concerns Related to genetic introgression s and disease transmission. Ceratomyxa may eliminate most planted trout within several weeks. Current level of trout passag into the Feather River from Thermalito Afterbay Outlet of Thermalito Diversion Dam is yet-undetermined. One way to determine the numb of trout passing through the Thermalito Afterbay Outlet to the Feather River is to install a fish counting and identification device at the Thermalito Afterbay Outlet. Currently rainbow trout are stocked in the Thermalito Forebay for a "put and take" fishery. This Resource Action will address concerns about hatchery origin trout interacting with natus steelhead in the Feather River. Ceratomyxa may eliminate most planted trout within several weeks.

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EWG-13A	Low Flow Channel	Improve Fish Rearing Habitat Enhancement	Woody Debris Recruitment for Juvenile Fish Rearing Habitat	Add woody debris in the Feather River. Large woody debris would be anchored or inserted into the river at target locations to provide increased habitat complexity. Source areas for woody debris are upstream of Lake Oroville (FR-4, FR-23)			X	X	X	X	X	-Characterize current instream woody debris quantity and distribution: SP-F3.2 Task 4	Related to EWG-20. Additional information on the viability and sustainability of LWD placement in the Feather River flow regime and identification of candidate sites is required. Richard Harris will provide a summary of his site visit to the Low Flow Channel with respect to opportunity to augment LWD in the LFC. Needs to be further developed.
EWG-13B	Low Flow Channel	Improve Fish -Rearing Habitat	Increase Habitat Complexity to Improve for rearing juvenile steelhead and Chinook salmon Juvenile Fish Rearing Habitat	Provide additional salmonid rearing habitat within the existing main channel of the LFC by creating additional cover, edge and flow complexity. This could be accomplished through the addition large-woody debris, boulders, and other objects, and by the creation of midchannel gravel islands. The goal of these main channel enhancements would be to provide in-stream cover, but also to increase the area of shallow-edge habitats within existing riffles and glides. Add structures such as boulders, etc in the Feather River at target locations to provide increased habitat complexity. The primary target for this Resource Action would be rearing steelhead and a secondary target would be rearing Chinook salmon. (FR-4, FR-23)			x	X	X	X	X	-Characterize instream woody debris quantity and distribution and cover distribution: SP- F3.2 Task 4	identified in EWG-16. Cover enhancement in pools should generally be
EWG-14	Low Flow Channel	Increase Holding Habitat	Additional Holding Habitat for Adult Spring- Run Chinook Salmon	Create deep pools in low-flow reach of Feather River to provide holding habitat for spring-run Chinook salmon. Deep pools would be created in reaches where water temperatures are expected to be cool enough to provide summer habitat for spring-run Chinook salmon. (FR-5)	X		X	X	X	X	X	Spring-run Chinook salmon holding habitat: SP-F10 Task 1E	SP-F10 Task 1E indicates that potential holding pools are of adequate depth. Disruption of substrate during pool excavation Mmay impact water quality. Ongoing studies in SP-F10 Task 1E will to-determine when and where spring-run Chinook over-summer in the low flow channel.
EWG-15	Low Flow Channel	Increase Fish Spawning Habitat	Spawning Habitat for Chinook Salmon and Steelhead	Incrementally increase flows in the low-flow reach of the Feather River during the Chinook salmon and steelhead spawning season (SeptDec)s to increase habitat quantity by providing opportunity for expanded lateral spawning distribution. Reduce redd superimposition and provide additional usable spawning habitat. (FR-6)		X			X	X	X	Chinook salmon and	Needs further analysis. additional information regarding the target flow range in which this action would occur and the duration of the flow increases. Also see IFIM study. SP-F16 may be able to-provide an assessment of the benefit associated with this Resource Action by evaluating lateral redd distribution in response to flow changes.
EWG-16 <u>A</u>	Low Flow Channel	Increase Fish -Rearing Habitat	Rearing Habitat for Juvenile <u>Salmonid</u> Fish Species	Create_restore and/or improve side-channel habitat adjacent to the low-flow reach in the Feather River. DWR studies have found that juvenile steelhead trout strongly select shallow riffle/glide, near-shore habitats with abundant riparian and in-stream cover. Habitats meeting these criteria are most often found in side-channels. Currently preferred habitats of juvenile steelhead are not common in the LFC. To expand availability of preferred rearing habitat, side channels should be constructed at various suitable areas within the LFC. Potential sites for side channel creation in the LFC include (from upstream to downstream): Aleck Riffle, Great Western Riffle, Robinson Riffle/Borrow Pond, Steep Riffle, between Eye and Gateway Riffles, and the Oroville Wildlife Area south east of the Thermalito Outlet. The increased habitat complexity will benefit protected, sensitive, or other desired juvenile fish species. (FR-7, FR-8, FR-33)		X	X	X	x	X	X		Side channel creation will be most effective if conducted in combination with base flow increase, planting of riparian vegetation, and reestablishment of flow through historic river channels. Needs further analysis on how side-channel habitat will be restored created. Ongoing studies associated with SP-G2 will provide data. Could be combined with EWG-21. Detailed site evaluations will be necessary to determine which sites are most amenable to side channel creation or enhancement. DWR staff will provide information on specific sites.

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<u>EWG-16B</u>	Low Flow Channel	Rearing Habitat	Rearing Habitat for Juvenile Salmonid Fish Species	Restore and/or improve side-channel habitat adjacent to the low-flow reach in the Feather River. Two existing side channels at the upstream end of the LFC, Hatchery Ditch and Moe's Ditch, would benefit from habitat and flow enhancements. Hatchery Ditch, a primary steelhead spawning and rearing reach, is currently fed solely by seepage form the Feather River Hatchery (FRH) settling pond. Discharge in Hatchery Ditch is directly related to water use in the hatchery. Hatchery Ditch requires its own water source so that it can function independently. This need is particularly pressing since the FRH water system is overdue for a major overhaul, which requires shutting down the hatchery water supply for several months. Moe's Ditch is a man-made spawning channel adjacent to Hatchery Ditch. Currently Moe's Ditch suffers from a lack of flow (due to upstream changes in bed morphology) and a lack of cover and channel sinuosity.		<u>X</u>	<u>x</u>	<u>x</u>	<u>x</u>	X	<u>X</u>	SP-F16; SP-G2	Detailed site evaluations will be necessary to determine which sites are most amenable to side channel creation or enhancement. Needs further analysis on how side-channel habitat will be restored. Ongoing studies associated with SP-G2 will provide data. Could be combined with EWG-21.	
EWG-17	Low Flow Channel	Increase Fish Rearing Habitat	Rearing Habitat for Juvenile Fish Species	Enhance riparian vegetation (including trees) along banks for shading and increased habitat complexity. This could include the use of cottonwoods or alders. (FR-9)		X		X	X	X	X	Identify and Characterize fish habitat: SP-F3.2 Task 4 Influence of cover on habitat suitability: SP-F16	One location for vegetation enhancement could be 'trailer park riffle' along east side, although drawback is that high-water events may require continued maintenance/improvement of this area. Need to potential evaluate site locations. Additional considerations include that if channels become completed tree-lined, increases in flow may actually cause a decrease in the amount of shallow water habitat available.	
EWG-18	Low Flow Channel	Increase Fish-Spawning Habitat	Spawning Habitat for Chinook Salmon and Steelhead	In areas where armoring has occurred, selected sections of the low-flow reach of the Feather River would be ripped with the goal of improving spawning gravel quality. (FR-10)			X	X	X	X	X	Spawning gravel quality and armoring - SP-F10 Task 2A SP-G2	Areas suitable for ripping are uncertain at this time; further information will be obtained after results from SP-F10 Task 2A have been issued. Ripping may result in turbid water and therefore 4Mmay impact water quality. Related to EWG-90.	
EWG-19	High Flow Channel	Increase Fish Spawning Habitat and Rearing Habitat	Increase Splittail Spawning Habitat and juvenile Chinook salmon rearing habitat	Modify existing or build vegetated "benches" at various stage elevations in the lower Feather River near Verona to enhance splittail spawning habitat and Chinook salmon rearing habitat. (FR-22)		X	X	X	X	X	X		Similar to EWG-22. Benches that provide inundated vegetation would provide suitable habitat for splittail spawning and provide valuable rearing habitat for Chinook salmon. Need additional information from SP-F3.2 Task 3B including the location and stage that would be required to inundate the constructed benches. Benches should be constructed so that they do not become potential stranding locations for juvenile salmonids.	
EWG-19A (assign new number)	High Flow Channel	Increase Fish Spawning Habitat	Spawning Habitat for Chinook Salmon and Steelhead	Increase Manage the operational flexibility to allow for decreases in water temperatures downstream of the Thermalito Afterbay Outlet during the Chinook salmon spawning season to encourage gravel-utilization of existing suitable gravel downstream of Thermalito Afterbay Outlet by: - increasing the proportion of LFC flow in the HFC - decreasing residency time of water in the Thermalito Afterbay	X	X		X		X	X	SP-F10 Task 2C	See also EWG 36 & EWG-37. Decreasing water temperatures may result in conditions more suitable for IHN infection.	

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EWG-20	High Flow Channel	Spawning <u>Rearing</u> Habitat Enhancement	Woody Debris Recruitment Placement for Juvenile Fish Rearing Habitat	Add woody debris in the Feather River. Large woody debris would be anchored or inserted into the river at target locations to provide increased habitat complexity. (FR-23, FR-4)		X	X	X	X	X	instream woody debris	Additional information on the viability and sustainability of LWD placement in the Feather River flow regime and identification of candidate sites is required. Related to EWG-13Higher complexity LWD generally provides relatively high quality juvenile rearing habitat value but has a shorter longevity then low complexity LWD This Resource Action would provide the related benefit of increasing organic inputs.
EWG-21	High Flow Channel	Increase Fish Rearing Habitat	Rearing Habitat for Juvenile Salmonids	Increase quantity of shallow water rearing habitat for juvenile salmonids in the high flow section of Feather River by releasing higher flows. (FR-24)	2		X	x	X	X	Transect data: SP-F16 and SP-G2; Habitat suitability information for rearing Chinook and steelhead: SP-F16-	Related to EWG-16A and EWG-16B. Increasing flows may or may not provide additional shallow water habitat depending upon the shape of the channel. Increased flows may result in loss of suitable habitat with respect to velocities. SP-F16 may provide information describing the relationship between flow and availability of Chinook and steelhead juvenile rearing habitat.
EWG-22	High Flow Channel	Increase Fish Rearing Habitat		Increase connectivity between river channel and lateral-floodplain habitats (including side channel floodplainslow-elevation terraces) in lower Feather River by setting back levees to create seasonal habitats for Chinook salmon, splittail, and steelhead, and sturgeon. (FR-25)	Σ	X	X	X	X	X		Ongoing studies associated with SP-G2 will provide additional data. Related to EWG-21, EWG-23, EWG-25, & EWG-36. Repositioning levees may affect flood control. Removing levees will likely impact flood control.